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The major part of this investigation concerned the interacting binary SV Cen. A paper describing this part of the investigation has been accepted for publication in the Astrophysical Journal. The primary results of the study are as follows.

1)The light synthesis elements to represent U, B, V light curves by Dreschel, Rahe, and Wargau do not give a good representation of the observations. There is a substantial O'Connell effect which these authors do not model at all. This effect is unexpected in a hot system, since the usual explanation of its presence is cool starspots on the more massive component. A second effect is delay of light maximum to orbital phase 0.27. Starspot facilities in the author's light synthesis program permits calculation of either hot or cool starspots, on either stellar component in a binary system. It was found empirically that a single equatorial hot spot on the advancing face of the less massive component would represent both light curve anomalies. However, even including this improvement, the light synthesis representation of the observations was unsatisfactory. The major difficulty was too large a calculated light loss during all of secondary minimum, when the larger, more massive component was in eclipse.

2)The difference in depths of the two minima requires an intercomponent temperature discontinuity of 8000K, in the sense that the less massive secondary is hotter. Yet the light synthesis solution produces a contact system that has the photosphere nearly coincident with the outer critical surfacr through the L2 point. These two aspects of the light synthesis solution are contradictory, and lead to the suspicion that SV Cen violates a basic aspect of the model on which the light synthesis model is built.

3)A possible explanation of the above results is that SV Cen is a semi-detached system with an accretion disk surrounding the hot mass gainer. Secondary minimum is caused by eclipse of the larger mass loser by the accretion disk of the mass gainer. The existing light synthesis program does not model a situation like this, in which both stellar components as well as the accretion disk contribute detectably to the observed light, and, to the author's knowledge, no other existing light synthesis program does either. A new development program will shortly be started to model this situation.

4)Dreschel et al. found what they believed to be a hot spot in the system from IUE low dispersion spectra. This result followed from representation of the separate component spectra by black body curves. Differencing their sum and the observed IUE continuum left a residual which they interpreted as a 200,000K source in the system, of small size. Together with a graduate student, the author has developed a spectrum synthesis program which permits generation of composite spectra for a contact binary system at any orbital phase. The program produces Kurucz-type spectra. This new facility was used to generate synthetic spectra for SV Cen, for comparison with the IUE observations. An important initial expectation was that the poor representation of spectra of hot stars by black body curves might modify the Dreschel et al. conclusions. In fact, the comparison showed there is no 200,000K hot spot. However, the comparison did reveal extra continuum radiation longward of 200nm. The proposed explanation is that this radiation represents emission from the accretion disk outer rim. The development of the spectrum synthesis facility is one of the major accomplishments of this investigation.

5)The model of SV Cen which emerges from this study is a mass transfer system nearing mass reversal, but with an accretion disk surrounding the mass gainer rather than an overcontact system. Since many theoretical studies have argued that a mass gainer will swell to produce an overcontact system, there is a major disagreement with the new proposed model. The proposed escape is that the theoretical studies all assume spherical accretion. This assumption is appropriate for white dwarfs or neutron stars, but is inappropriate for stars of main sequence dimensions. As part of the paper argument, I call for use of the current theoretical programs to model beta Lyrae, a system known to have an accretion disk and a mass gainer of about ZAMS dimensions. The author's prediction is that the theoretical programs will derive an overcontact model for beta Lyrae today, in disagreement with observation.

There is an interesting connection of SV Cen with the largest group of contact binary systems, the W Ursae Majoris stars. In the case of massive systems like SV Cen there is no doubt that mass transfer from the more massive component to the less massive component takes place, leading to mass reversal. But in W UMa stars, the current model by Mochnacki argues that the more massive component gradually decants mass from the less massive component, eventually leading to coalescence into a single star. The question of where the crossover takes place has never been studied in detail. A second common point is that the secondary component in W-type W UMa systems is hotter, as with SV Cen. Further, there are known problems in the ultraviolet region for W-type W UMa systems, in particular for W Ursae Majoris itself. Two papers on W Ursae Majoris itself are in press that discuss this problem. It is found that there likely is an elevated temperature region in the neck joining the two components. The reason for this effect is unknown. The simulation of this effect made use of a new option in the light synthesis program. This option permits empirical modification of the normal temperature profile on the component photospheres to produce elevated temperatures on the inner faces of the two components. It is shown that elevated temperatures in these regions gives rough accord with observational data at 250nm.

As part of providing facilities to simulate effects of starspots, either hot or cool, a new optimization program has just been completed. This program optimizes the four parameters representing a starspot. They are angular radius, longitude, latitude, and temperature contrast from the adjacent photosphere. The optimization program has been shown to work properly in optimizing parameters for two pairs of starspots. This program has just been completed and no description of it has yet been written.

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